Far Mill River

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Far Mill River watershed covers an area of approximately 9,657 acres in the southwestern portion of Connecticut (Figure 1). There are four municipalities located at least partially in the watershed, including Monroe, Shelton, Stratford, and Trumbull, CT.

The Far Mill River watershed includes one segment impaired for recreation due to elevated bacteria levels. This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed were currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of waterbodies in the watershed (CT DEEP, 2010).

The Far Mill River begins near the intersection of Route 111 and Elm Street in Monroe, and flows southeasterly through the Far Mill (Isinglass) Reservoir. The bacteria impaired segment (CT6025-00_02) consists of 3.99 miles of the river in Shelton and Stratford (Figure 2). The impaired segment begins at the confluence with Means Brook near Sycamore Drive in Shelton, flows southeast across Route 8, and ends at Route 110 on the Shelton-Stratford border at the Wilson Gardens Dog Pond outlet (Figure 2). The Far Mill River continues southeasterly and empties into the Housatonic River.

The impaired segment of the Far Mill River has a water quality classification of B. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in this segment of the Far Mill River, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment:
Far Mill River (CT6025-00_02)

Municipalities: Shelton, Stratford

Impaired Segment Length (miles): 3.99

Water Quality Classification:
Class B

Designated Use Impairment:
Recreation

Sub-regional Basin Name and Code: Far Mill River, 6025

Regional Basin: Housatonic Main Stem

Major Basin: Housatonic

Watershed Area (acres): 9,657

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

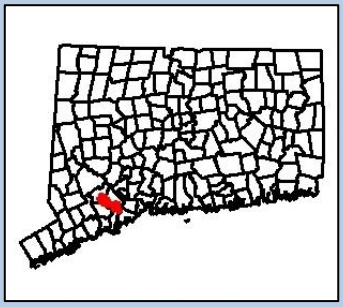
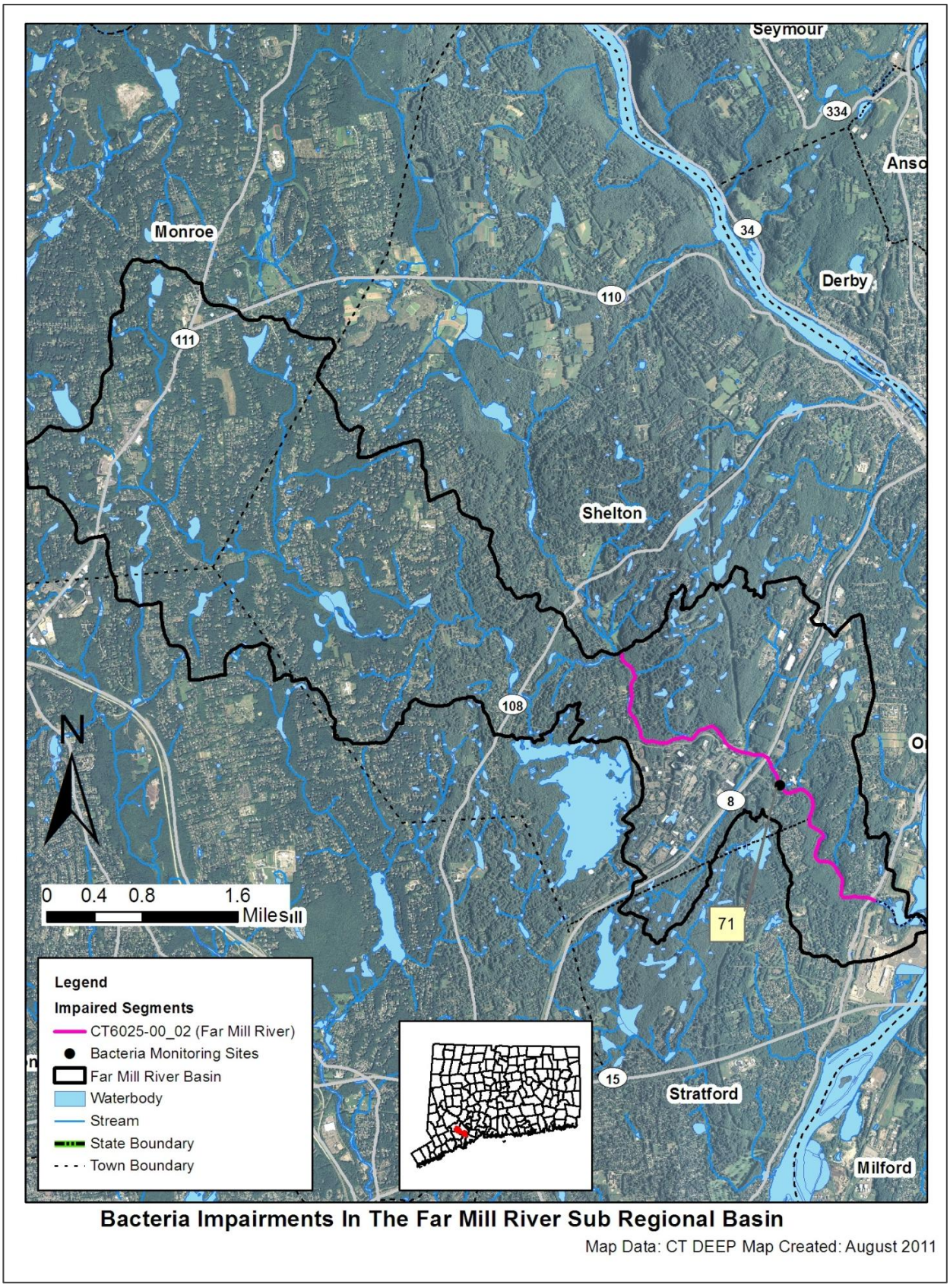


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT6025-00_01	Far Mill River-01	From saltwater limit (head of marsh) at confluence with Housatonic River, US to Wilson Gardens Dog Pond outlet dam at River Road (Route 110) crossing (ponded portion), Shelton/Stratford town border. (Lower portion in LIS CT-C1_020-SB)	0.19	U	U	FULL
CT6025-00_02	Far Mill River-02	From River Road (Route 110) crossing (Wilson Gardens Dog Pond outlet dam), Shelton/Stratford town border, US to confluence with Means Brook (US of Sycamore Drive crossing), Shelton.	3.99	FULL	NOT	FULL
CT6025-00_03	Far Mill River-03	From confluence with Means Brook (just DS of Huntington Street crossing), US to Far Mill (Isinglass) Reservoir outlet dam, just US of Far Mill Street crossing (beginning of drinking water watershed), Shelton.	3.33	NOT	U	FULL
CT6025-00_04	Far Mill River-04	From Far Mill (Isinglass) Reservoir inlet (in drinking water watershed), Shelton, US to headwaters (just US of Elm Street crossing, Monroe Turnpike (Route 111) area), Monroe.	3.05	U	U	FULL

Shaded cells indicate impaired segment addressed in this TMDL
FULL = Designated Use Fully Supported
NOT = Designated Use Not Supported
U = Unassessed

Figure 2: GIS map featuring general information of the Far Mill River watershed at the sub-regional level



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Far Mill River watershed consists of 52% urban area, 43% forest, 3% water, and 2% agriculture. Most of the forested areas are located in the riparian zone of the Far Mill River, such as Far Mill Park in Shelton. Agricultural areas are scattered throughout the watershed with some farms located in the riparian zones of the upstream portions of the Far Mill River (Figure 4).

Figure 3: Land use within the Far Mill River watershed

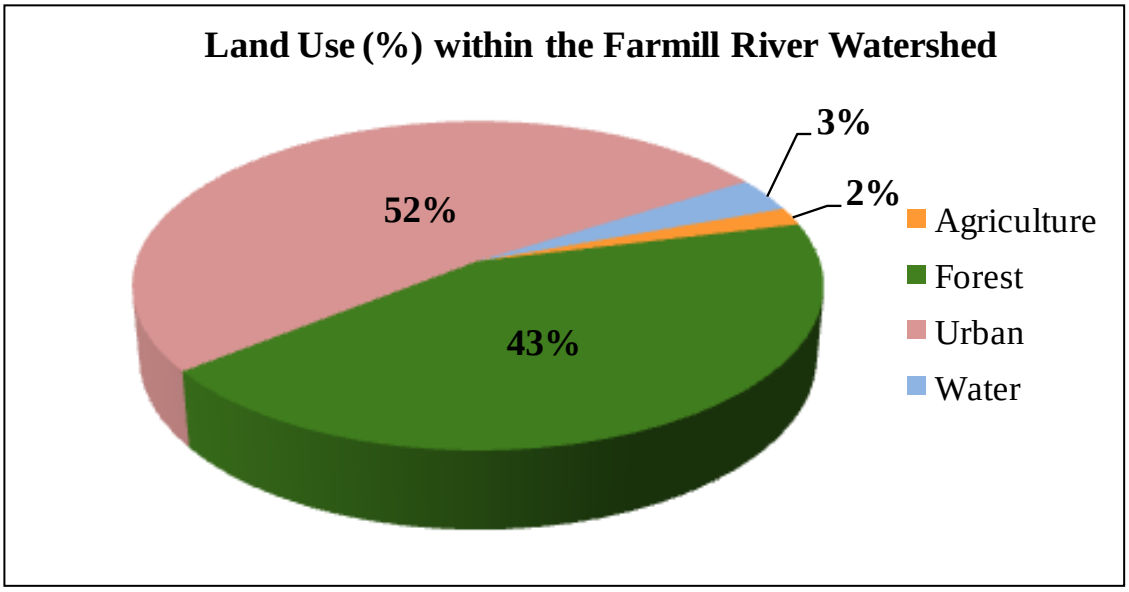
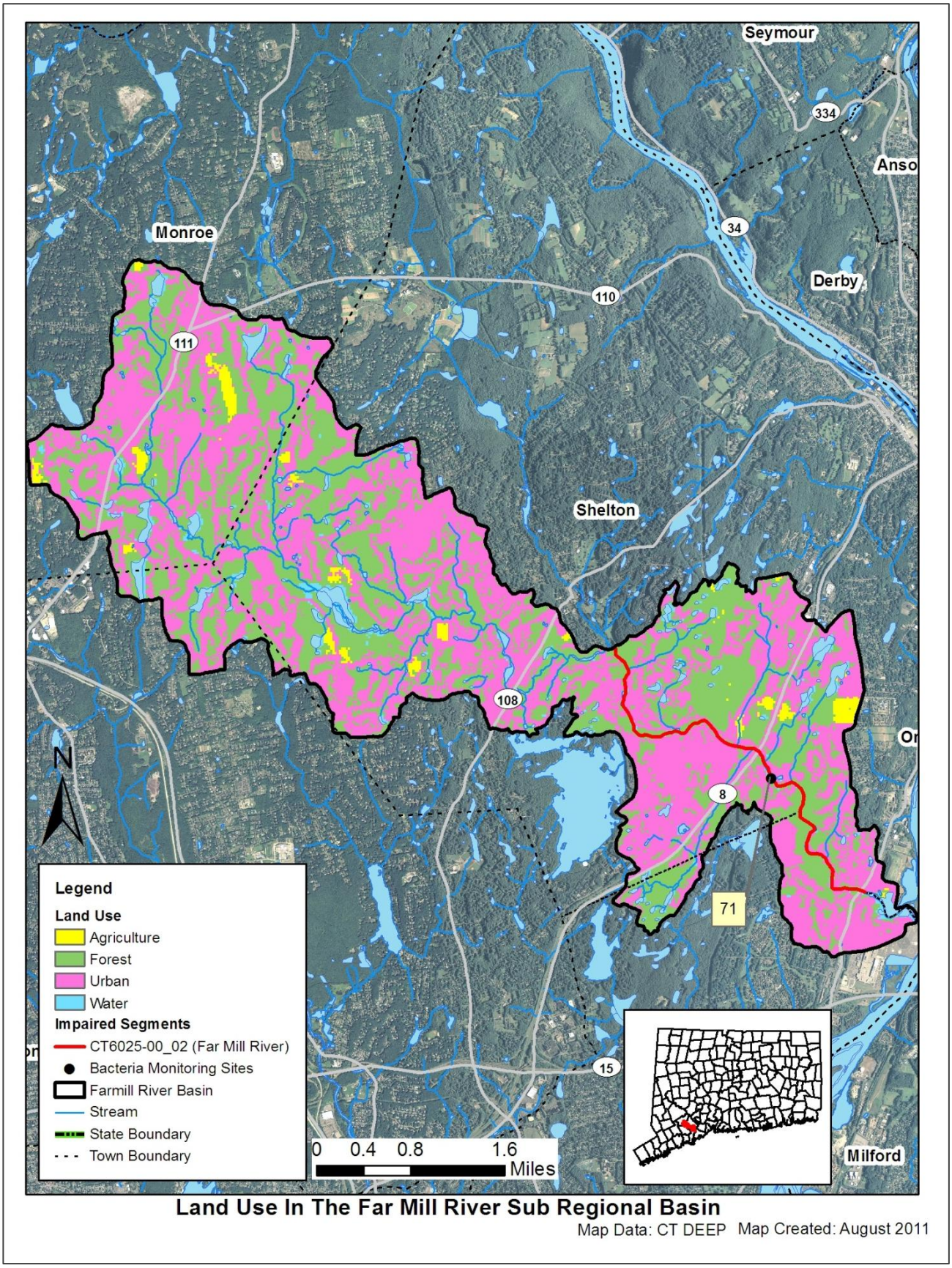


Figure 4: GIS map featuring land use for the Far Mill River watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segment of the Far Mill River

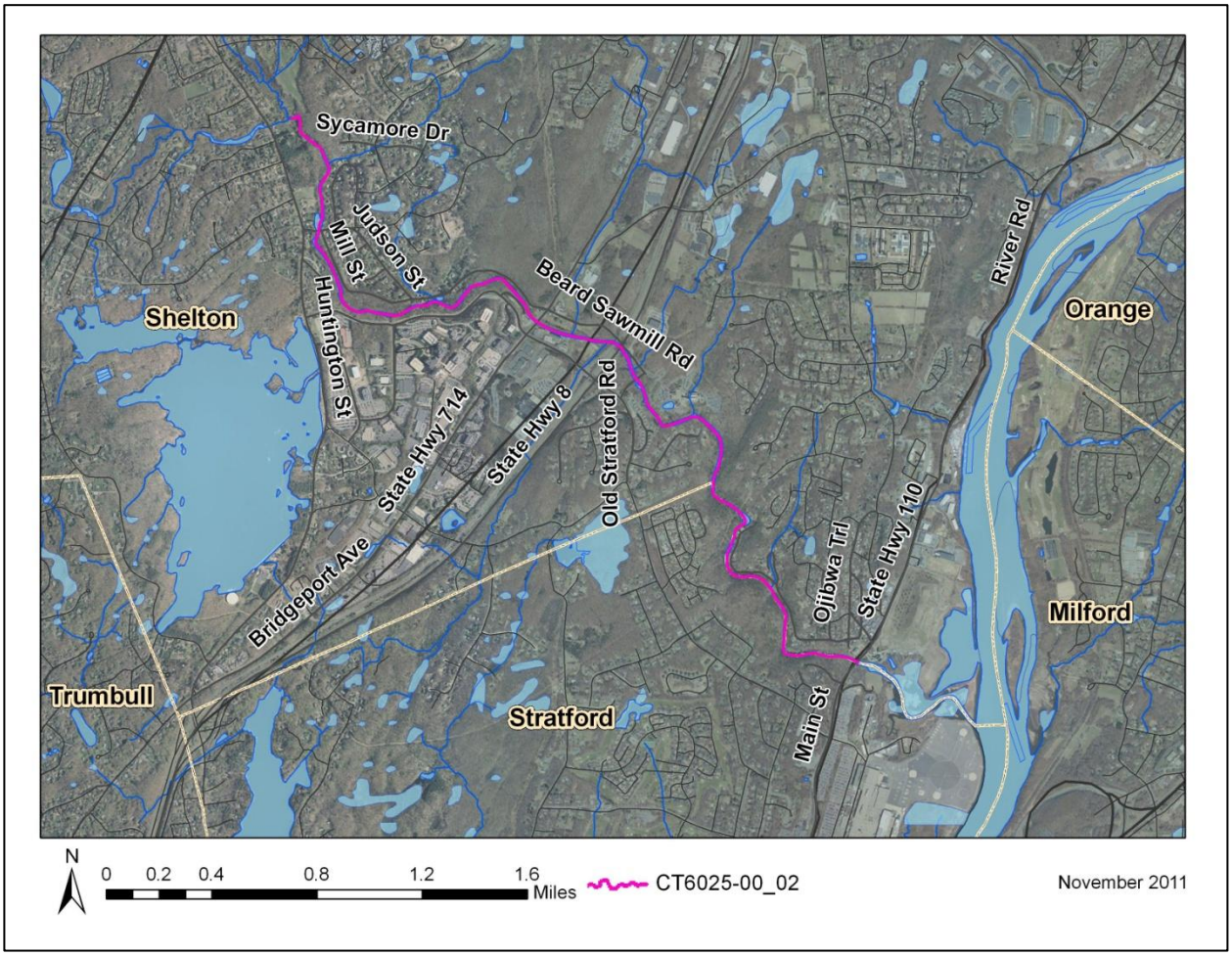
Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT6025-00_02	Far Mill River	71	Route 8 at Old Bridge	Shelton	41.272964	-73.112911

The Far Mill River (CT6025-00_02) is a Class B freshwater river (Figure 5). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 2006 - 2009 (Station 71) (Table 2). Water quality criteria for *E. coli*, along with bacteria sampling results from 2006-2009, are presented in Table 11. The annual geometric mean was calculated for Station 71 and exceeded the WQS for *E. coli* in all years. Single sample values at this station also exceeded the WQS for *E. coli* multiple times each year.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days for Station 71 on the Far Mill River (Table 11). Geometric means during both wet and dry-weather exceeded the WQS for *E. coli* with wet-weather higher than dry-weather.

Due to the elevated bacteria measurements presented in Table 11, this segment of the Far Mill River does not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of the Far Mill River



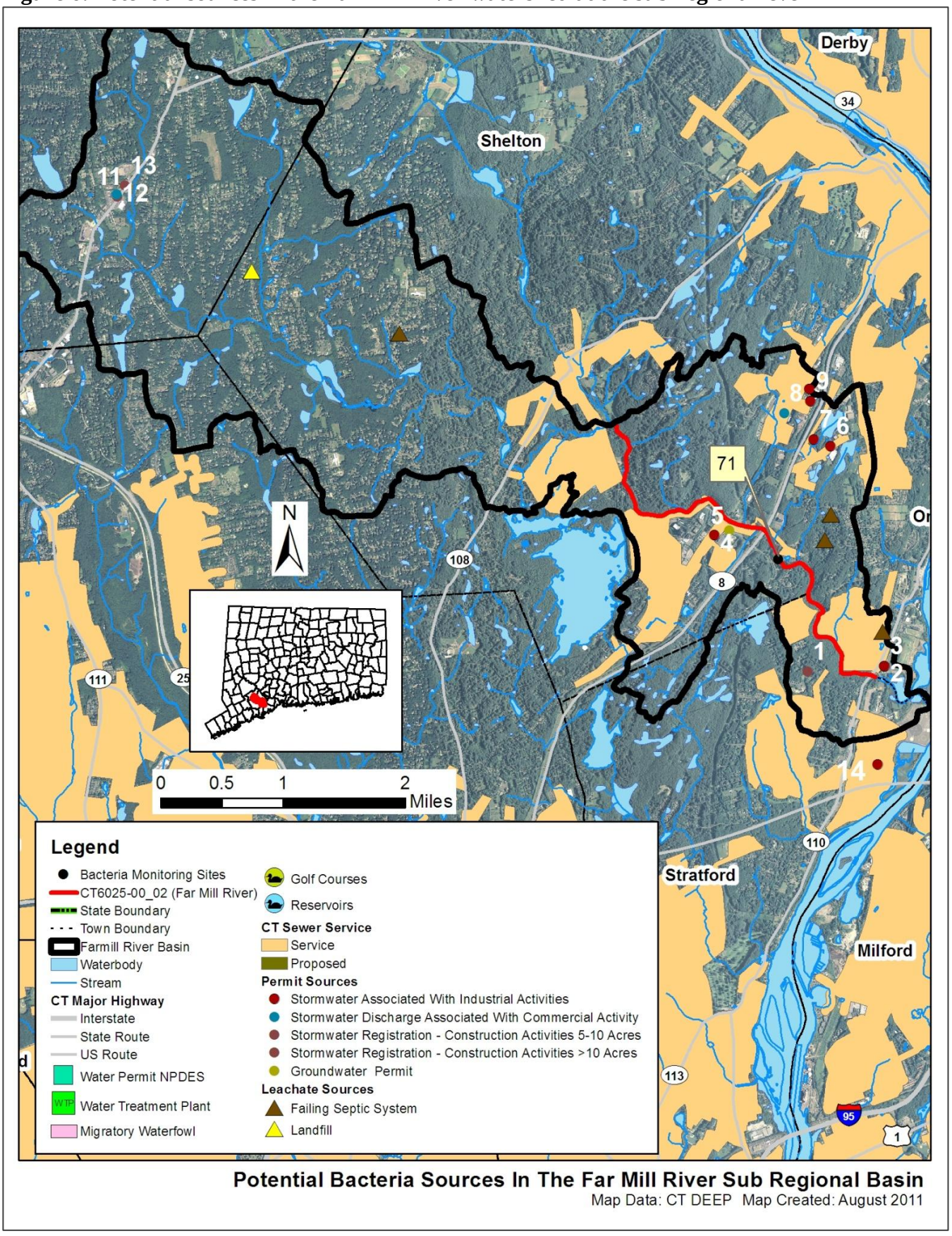
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the Far Mill River watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segment. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not mean that there are no data or impairments existing in the segment. For some segments, there are data from permitted sources and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Far Mill River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/ SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Far Mill River CT6025-00_02	x	x		x	x	x	x	x

Figure 6: Potential sources in the Far Mill River watershed at the sub-regional level



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring may reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Tables 6 and 7.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	2
GSI	Stormwater Associated with Industrial Activity	7
GSM	Part B Municipal Stormwater MS4	3
GSN	Stormwater Registration – Construction	3
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	1

Other Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Far Mill River watershed. Bacteria data from 2001 – 2003 from some of these industrial permitted facilities are included in Table 6. Though this data cannot be compared to a water quality standard as there is no recreation standard for fecal coliform in Connecticut, multiple samples were high with results from Shelton Landfill (GSI000512) exceeding 10,000 colonies/100 mL, and Sikorsky Aircraft Corporation (GSI000768) exceeding 6,000 colonies/100 mL. The Sikorsky Aircraft Corporation is located near the confluence of the Far Mill River and the Housatonic River downstream of the impaired segment, represented by point #14 in Figure 6. Although the Sikorsky Facility seems to lie outside the watershed, it actually straddles the watershed boundary and a portion of its stormwater discharge extends into the watershed. Any discharge exceedances at this site may contribute to future impairments in the lower reaches of the Far Mill River.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Far Mill River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Monroe	Town of Monroe	GSM000013	Part B Municipal Stormwater MS4	Town of Monroe	N/A
Monroe	The Stop & Shop Supermarket Company Llc	GSC000355	Stormwater Discharge Associated With Commercial Activity	Monroe Super Stop & Shop #685	12
Monroe	The Stop & Shop Supermarket Company Llc	GSN001894	Stormwater Registration - Construction Activities 5-10 Acres	Super Stop & Shop	13
Monroe	The Stop & Shop Supermarket Company Llc	GSN001896	Stormwater Registration - Construction Activities 5-10 Acres	Super Stop & Shop	11
Shelton	Lord Corporation	UI0000418	Groundwater Permit	Lord Corporation	5
Shelton	City of Shelton	GSM000045	Part B Municipal Stormwater MS4	City of Shelton	N/A
Shelton	Precision Resource Inc.	GSI000194	Stormwater Associated With Industrial Activities	Precision Resource, Inc.	7
Shelton	Connecticut Resource Recovery Authority Transfer Station	GSI000512	Stormwater Associated With Industrial Activities	Shelton Transfer	2
Shelton	Anco Engineering	GSI001767	Stormwater Associated With Industrial Activities	Anco Engineering	6
Shelton	Ct Waste Transfer	GSI001848	Stormwater Associated With Industrial Activities	Shelton Ct Waste Transfer Vrp	10
Shelton	Connecticut Waste Transfer, Llc	GSI001916	Stormwater Associated With Industrial Activities	United Recycling Of Shelton, Llc	9
Shelton	Ra 710 Bridgeport Avenue Llc	GSI002000	Stormwater Associated With Industrial Activities	Perkin Elmer Health Sciences, Inc.	4
Shelton	City Of Shelton	GSI002216	Stormwater Associated With Industrial Activities	Shelton Transfer Station	3
Shelton	Wal-Mart Stores East	GSC000284	Stormwater Discharge Associated With Commercial Activity	Wal-Mart Store #2163	8
Startford	Town of Stratford	GSM000105	Part B Municipal Stormwater MS4	Town of Stratford	N/A

Table 5: Permitted facilities within the Far Mill River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Stratford	Maple Oak Reserve, Llc	GSN001829	Stormwater Registration - Construction Activities >10 Acres	Maple Oak Reserve	1
Stratford	Sikorsky Aircraft Corp	GSI000768	Stormwater Associated with Industrial Activities	Sikorsky Aircraft	14

Table 6: Industrial permits on the Far Mill River and available fecal coliform data (colonies/100 mL). The results cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-001	08/10/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-001	07/23/02	30
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-003	08/23/01	16
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-003	07/23/02	75
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-004	08/23/01	6,000
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-004	06/05/02	4
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-006	08/23/01	132
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-006	08/20/02	4
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-007	08/23/01	76
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-007	08/20/02	16
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-011	08/23/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-011	06/05/02	12
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-011	07/16/03	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-013	08/23/01	48
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-013	06/05/02	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-013	07/16/03	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-015	08/10/01	75
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-015	07/23/02	28
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-016	08/23/01	28
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-016	07/23/02	49

Table 6: Industrial permits on the Far Mill River and available fecal coliform data (colonies/100 mL). The results cannot be compared to the water quality standard as there is no recreation standard for fecal coliform. (continued)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-017	08/23/01	5
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-017	07/23/02	42
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-018	08/23/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-018	07/23/02	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-019	08/23/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-019	07/23/02	68
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-020	08/23/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-020	08/20/02	6
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-021	08/10/01	15
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-021	06/05/02	6
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-021	07/16/03	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-022	08/23/01	80
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-022	07/23/02	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-028	08/10/01	0
Stratford	Sikorsky Aircraft Corp.	GSI000768	Far Mill & Housatonic	Stratford-028	07/23/02	0
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 001	01/30/01	100
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 001	09/14/01	3,200
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 002	09/14/01	400
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 003	01/30/01	10
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 003	09/14/01	10000
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 003	08/29/02	>2000
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 004	09/14/01	10000
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 004	08/29/02	>2000
Shelton	CRRA-Shelton Landfill	GSI000512	Far Mill River	DSN 005	01/30/01	10
Shelton	CRRA-Shelton Transfer Station	GSI000596	Far Mill River	001	09/14/01	10000
Shelton	CRRA-Shelton Transfer Station	GSI000596	Far Mill River	001	08/29/02	>2000

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

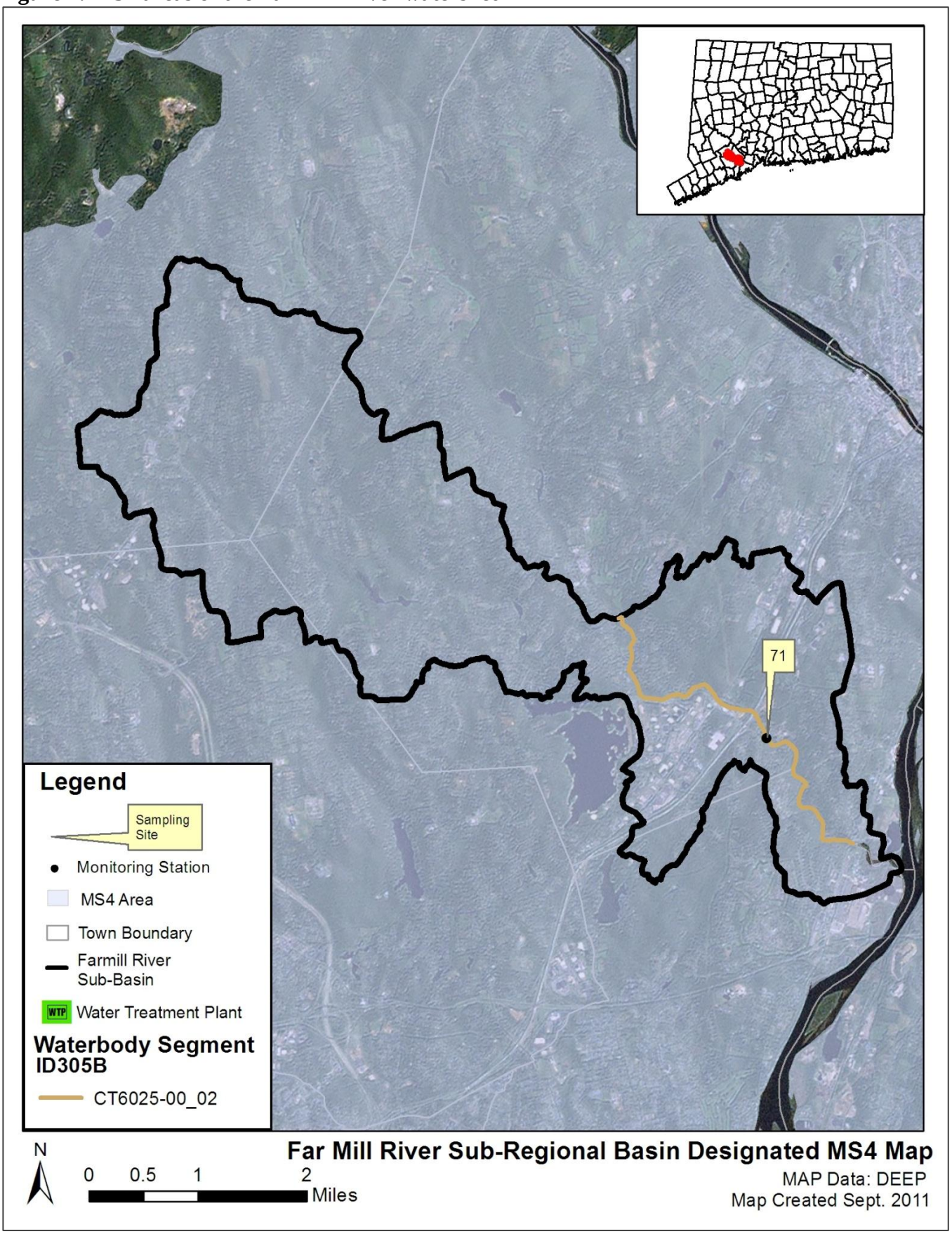
The Far Mill Brook watershed is located within the municipalities of Monroe, Shelton, Stratford, and Trumbull, CT. These municipalities have designated urban areas, as defined by the U.S. Census Bureau and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Multiple MS4 outfalls have been sampled for *E. coli* bacteria in the watershed (Table 7). In Monroe and Shelton, four MS4 outfalls were sampled from 2004 – 2011. Each outfall exceeded the WQS for *E. coli* once during the sampling period.

Table 7: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Far Mill River watershed

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Monroe	WS 2(2R) Church Street at Lover's Lane	Residential	Far Mill River	11/12/04	34
Monroe	WS 2(2R) Church Street at Lover's Lane	Residential	Far Mill River	11/22/05	710
Monroe	WS 2(2R) Church Street at Lover's Lane	Residential	Far Mill River	12/01/06	20
Monroe	WS 6 Route 111 100' N Ryegate Terrace	Commercial	Far Mill River	11/22/05	1,760
Monroe	WS 6 Route 111 100' N Ryegate Terrace	Commercial	Far Mill River	12/01/06	300
Monroe	WS 6 Route 111 100' N Ryegate Terrace	Commercial	Far Mill River	03/28/08	86
Shelton	FR-1-12 Commerce Drive	Commercial	Far Mill River	11/02/06	130
Shelton	FR-1-12 Commerce Drive	Commercial	Far Mill River	10/19/11	740
Shelton	FR-2- Commerce Drive at Progress Drive	Commercial	Far Mill River	11/02/06	50
Shelton	FR-2- Commerce Drive at Progress Drive	Commercial	Far Mill River	10/19/11	6,100
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Figure 7: MS4 areas of the Far Mill River watershed



Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Far Mill River watershed are described below.

Stormwater Runoff from Developed Areas

The majority of the Far Mill River watershed is developed (Figures 3 and 4). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000). The majority of the Far Mill River watershed, including the area surrounding the impaired segment, has 12-15% impervious surfaces. Upper portions of the watershed in Monroe and Shelton have 7-11% impervious surfaces (Figures 8 and 9).

High geometric means during wet-weather may indicate that stormwater runoff is contributing to the bacterial impairment of a river. As shown in Table 11, the geometric mean for wet weather exceeded the WQS at Station 71 on the Far Mill River, indicating that the Far Mill River is likely receiving bacteria from stormwater runoff.

Figure 8: Range of impervious cover (%) in the Far Mill River watershed

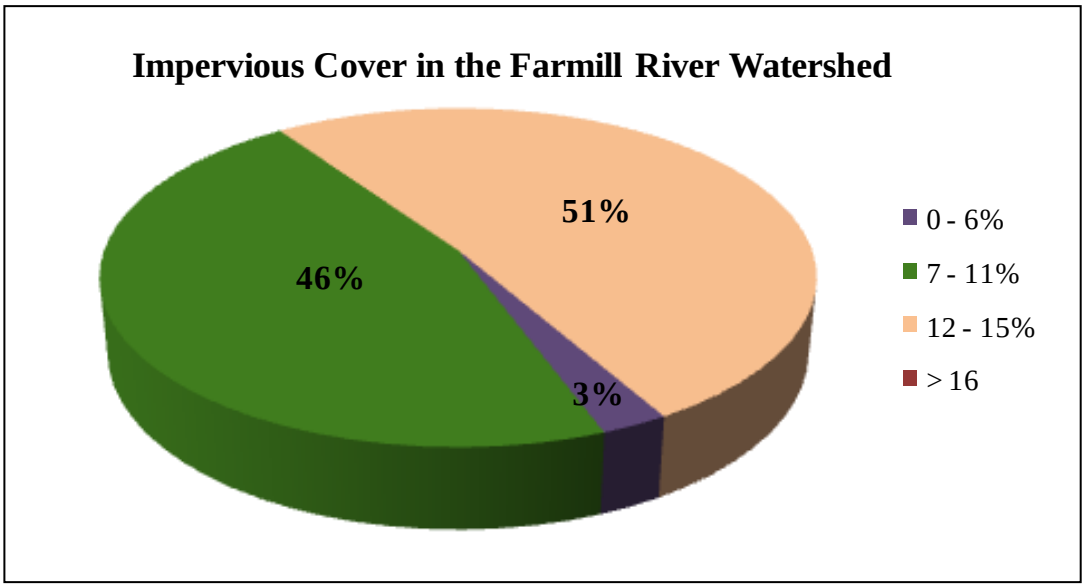
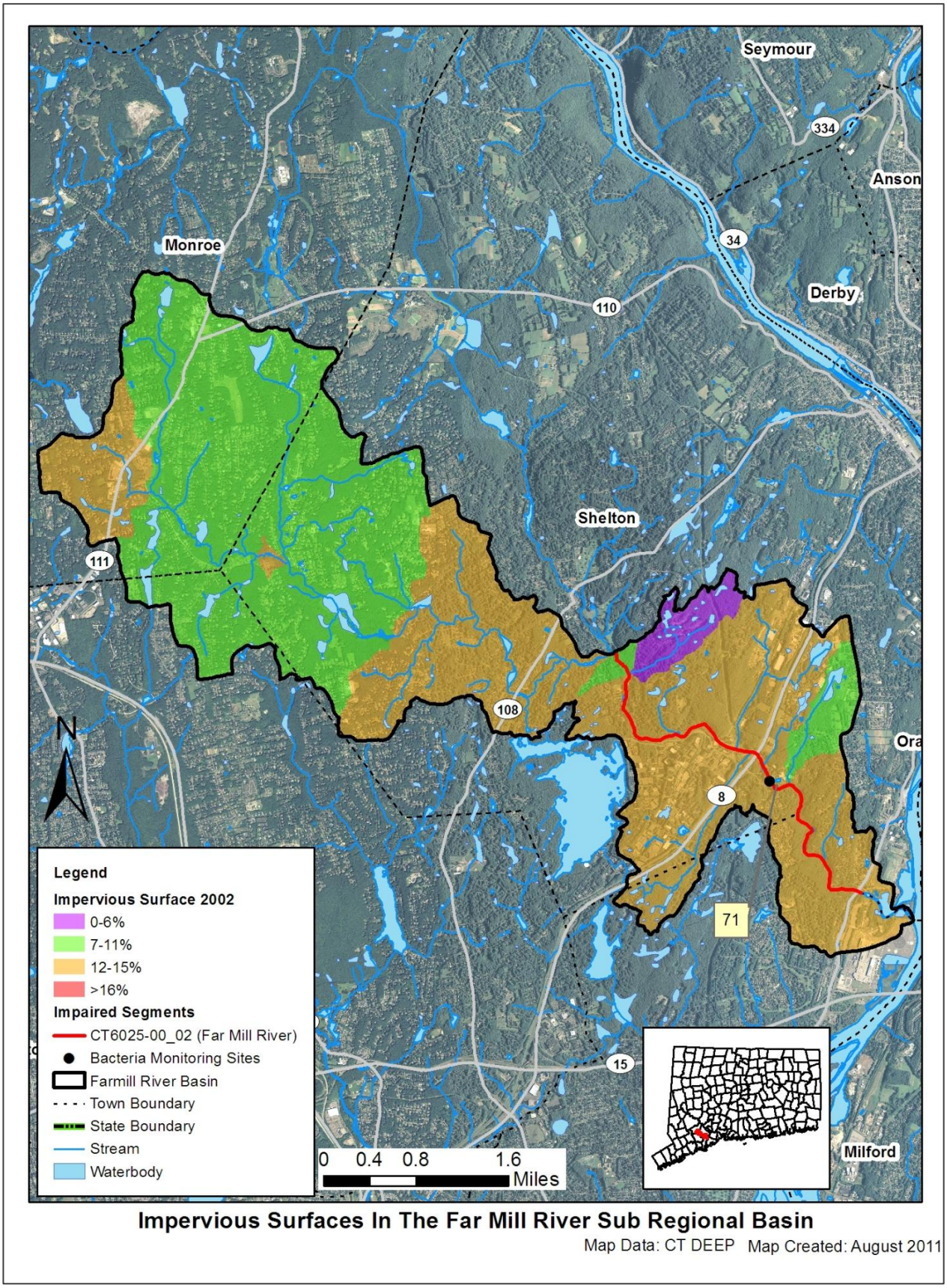


Figure 9: Impervious cover (%) for the Far Mill River sub-regional watershed



Illicit Discharges and Insufficient Septic Systems

As shown in Figure 6, the majority of the Far Mill Brook watershed relies on onsite wastewater treatment systems, such as septic systems. Properly managed septic systems and leach fields have the ability to effectively remove bacteria from waste. If systems are not maintained, waste will not be adequately treated and may result in bacteria reaching nearby surface and ground water. As shown in Figure 6, multiple septic system failures have been reported in the watershed, particularly near the impaired segment. These systems may be contributing to bacteria impairment in the Far Mill River watershed. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Towns of Monroe and Trumbull are part of the Trumbull-Monroe Health District (http://www.tmhd.org/), the Town of Stratford (http://www.townofstratford.com/content/1302/402/615/default.aspx) has a full time health director and the City of Shelton is part of the Naugatuck Valley Health District (http://nvhd.org/).

A portion of the watershed, including areas around the impaired segment, also relies on the municipal sanitary sewer system. Sewer system leaks and other illicit discharges can contribute bacteria to nearby surface waters.

High geometric means during dry-weather indicate that illicit discharges may be contributing to the bacterial impairment in a river. As shown in Table 11, the geometric mean for dry weather exceeded the WQS at Station 71 on the Far Mill River, suggesting that the impaired segment is possibly receiving bacteria from a dry weather source, such as insufficient septic systems.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Far Mill River watershed represent another potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001). As 43% of the watershed is undeveloped with Far Mill River Park and the Greenway (a 46-acre park in Stratford and Shelton along the banks of the Far Mill River), wildlife waste is a potential source of bacteria to the Far Mill River. Much of the watershed is also characterized by residential development. Waste from domestic animals such as dogs and horses, may also be contributing to bacteria concentrations in the Far Mill River.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Though agricultural land use makes up only 2% of the Far Mill River watershed, these farms are scattered throughout the watershed, particularly along the upper portion of the Far Mill River. Agricultural runoff from these farms and others in the area is a potential source of bacteria to the Far Mill River.

Additional Sources

The Shelton Landfill and the Transfer Station, located on Route 110 near the terminus of the impaired segment, are another potential source of bacteria. Discharges from the landfill and transfer station to the Far Mill River have shown high levels of fecal coliform bacteria (Table 6). There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in the Far Mill River. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

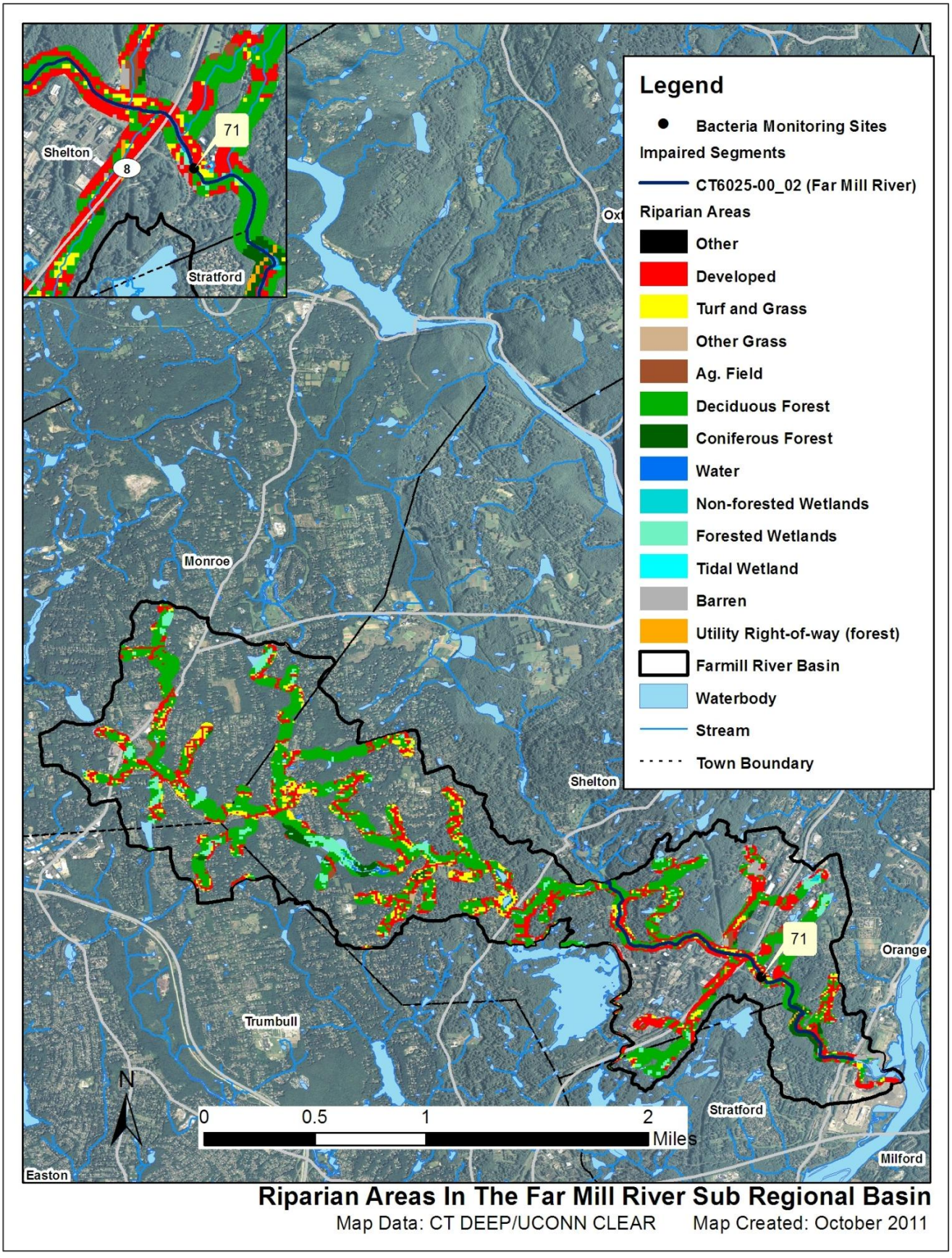
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The riparian zone of the impaired segment is characterized by a mix of forested and developed land uses (Figure 10). Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody since the natural riparian buffer is not available to treat this runoff.

Figure 10: Riparian buffer zone information for the Far Mill River watershed



CURRENT MANAGEMENT ACTIVITIES

The Towns of Monroe and Stratford and the City of Shelton have developed and implemented some programs to protect water quality from bacterial contamination. As indicated previously, the entire watershed is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 8 - 10.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Monroe, CT (Permit #GSM000013)

Minimum Measure	Monroe Annual Report Update (2010)
Public Outreach and Education	1) Local Eagle Scouts began catch basin stenciling program. 2) Continued Adopt-a-Road program. 3) Continued dispersing handouts about stormwater to the public. 4) Continued use of the town's website for stormwater information. 5) Involved local school custodians in stormwater training.
Public Involvement and Participation	1) Held seven radio broadcasts announcing their Stormwater Management Plan.
Illicit Discharge Detection and Elimination	1) Mapped all stormwater outfalls. 2) Continued IDDE program – no illicit discharges were detected. 3) Continued mandatory outfall sampling. 4) Currently reviewing draft illicit discharge ordinance.
Construction Site Stormwater Runoff Control	1) Continued inspections by the Engineering Department on all construction sites.
Post-Construction Stormwater management	No updates
Pollution Prevention and Good Housekeeping	1) Continued street sweeping program 2) Continued annual catch basin inspection and cleaning program.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Shelton, CT (Permit #GSM000045)

Minimum Measure	Shelton Annual Report Update (2009)
Public Outreach and Education	1) Printed and displayed the pamphlet "Septic Care and Maintenance for the Homeowner" in City Hall.
Public Involvement and Participation	1) Held annual volunteer clean-up days to remove trash along waterways.
Illicit Discharge Detection and Elimination	1) Completed map of existing storm sewer system. 2) Will conduct two rounds of wet weather sampling at 6 locations in 2010.
Construction Site Stormwater Runoff Control	No updates
Post Construction Stormwater management	No updates
Pollution Prevention and Good Housekeeping	1) Completed annual street sweeping. 2) Completed inspection on ¼ of the city's 4000 catch basin. Catch basins were cleaned and repaired when needed.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Stratford, CT (Permit #GSM000105)

Minimum Measure	Stratford Annual Report Update (2010)
Public Outreach and Education	1) Stormwater information distributed in public hallway information slots outside of Engineering and Building Departments. 2) A "Notice to Developers and Contractors" is attached to all zoning applications. 3) Received a grant for a stormwater stenciling program from LISFF. 4) Received a grant for training municipal employees. 5) Two educational brochures have been developed and distributed.
Public Involvement and Participation	1) Held a volunteer clean-up day (Project Greensweep) every other year since 2005.
Illicit Discharge Detection and Elimination	1) Developed a basemap of existing storm sewer system. 2) Approximately 30% of stormwater outfalls have been identified. 3) Conducted wet weather sampling at 6 locations during all permit years. 4) Drafted an IDDE/Stormwater ordinance that was not approved by the town council in 2010.
Construction Site Stormwater Runoff Control	1) Reviewed and revised zoning regulations to clarify and strengthen requirements for controlling stormwater runoff and maintaining effective erosion and sedimentation control measures.
Post Construction Stormwater management	1) Reviewed and revised zoning regulations to clarify and strengthen requirements for controlling stormwater runoff and maintaining effective erosion and sedimentation control measures.
Pollution Prevention and Good Housekeeping	1) Completed annual street sweeping. 2) Developed the Project First Impression to identify streets to sweep more regularly.

RECOMMENDED NEXT STEPS

The Towns of Monroe and Stratford and the City of Shelton have developed and implemented some programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Far Mill River and have been prioritized below.

1) Continue monitoring of permitted sources.

Previous sampling of discharges from the Shelton Landfill, the Transfer Station, and other permitted sources have shown elevated levels of fecal coliform bacteria, an indicator of bacterial pollution (Table 6). Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 11 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Far Mill watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 11. Bacteria (e.coli) TMDLS, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	1	2	3	1	2	3	**All**	**All**
B[4]	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

2) Identify areas along the developed portions of the Far Mill River to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 51% of the Far Mill River watershed is considered urban, and the municipalities within the Far Mill River watershed are MS4 communities regulated by the MS4 program. Most of the watershed has an impervious cover greater than 7%, and the areas surrounding the impaired segment of Far Mill River has an impervious cover of 12-15%. As such, stormwater runoff is likely contributing bacteria to the Far Mill River. To identify specific areas that are contributing bacteria to the impaired segment, the municipalities should continue wet-weather sampling at stormwater outfalls that discharge directly to the Far Mill River. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 7). To treat stormwater runoff, the municipalities should also identify areas along the more developed sections of the Far Mill River to install BMPs designed to encourage stormwater to infiltrate the ground before entering the river. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

3) Develop a system to monitor septic systems.

Though a portion of the residents within the Far Mill River watershed rely on the municipal sanitary sewer system, most residents rely on septic systems. If not already in place, Monroe, Shelton, and Stratford should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems. Particular attention should be paid to the failing septic systems identified in Figure 6.

4) Implement a program to evaluate the sanitary sewer system.

A portion of the Far Mill River watershed relies on a municipal sewer system. This area is concentrated in near the downstream portion of the watershed near the impaired segment (Figure 6). It is important for Shelton and Stratford to develop a program to evaluate its sanitary sewer and reduce leaks and overflows. This program should include periodic inspections of the sewer line.

5) Evaluate municipal education and outreach programs regarding animal waste.

As a large portion of the Far Mill River watershed is undeveloped, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the Far Mill River that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Far Mill River and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

6) Ensure there are sufficient buffers on agricultural lands along the Far Mill River.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located within the riparian buffer zone along the upstream reaches of the Far Mill River (Figure 10).

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 12: Far Mill River Bacteria Data

Waterbody ID: CT6025-00_02

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: 59%

Single Sample: 98%

Data: 2006-2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 71 on the Far Mill River with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
71	Downstream of Route 8 crossing at old bridge	6/1/2006	85	wet	247
71	Downstream of Route 8 crossing at old bridge	6/15/2006	165†	wet	
71	Downstream of Route 8 crossing at old bridge	6/21/2006	320	wet	
71	Downstream of Route 8 crossing at old bridge	6/29/2006	880	wet	
71	Downstream of Route 8 crossing at old bridge	7/12/2006	190	wet	
71	Downstream of Route 8 crossing at old bridge	7/20/2006	9200	wet	
71	Downstream of Route 8 crossing at old bridge	7/27/2006	63	dry	
71	Downstream of Route 8 crossing at old bridge	8/10/2006	195†	dry	
71	Downstream of Route 8 crossing at old bridge	8/17/2006	190	dry	
71	Downstream of Route 8 crossing at old bridge	8/24/2006	52	dry	

Single sample *E. coli* (colonies/100 mL) data from Station 71 on the Far Mill River with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
71	Downstream of Route 8 crossing at old bridge	6/17/2007	230	dry	**307* (59%)**
71	Downstream of Route 8 crossing at old bridge	6/20/2007	120	wet	
71	Downstream of Route 8 crossing at old bridge	7/5/2007	2200	wet	
71	Downstream of Route 8 crossing at old bridge	7/11/2007	170	dry	
71	Downstream of Route 8 crossing at old bridge	7/19/2007	550	wet	
71	Downstream of Route 8 crossing at old bridge	7/26/2007	31	dry	
71	Downstream of Route 8 crossing at old bridge	8/8/2007	**20000* (98%)**	wet	
71	Downstream of Route 8 crossing at old bridge	8/22/2007	450	wet	
71	Downstream of Route 8 crossing at old bridge	9/10/2007	63	dry	
71	Downstream of Route 8 crossing at old bridge	9/20/2007	74	dry	
71	Downstream of Route 8 crossing at old bridge	6/2/2008	200	dry	188
71	Downstream of Route 8 crossing at old bridge	6/11/2008	590	dry	
71	Downstream of Route 8 crossing at old bridge	6/18/2008	340	wet**	
71	Downstream of Route 8 crossing at old bridge	6/25/2008	97†	wet**	
71	Downstream of Route 8 crossing at old bridge	7/2/2008	230	dry	
71	Downstream of Route 8 crossing at old bridge	7/9/2008	110	dry	
71	Downstream of Route 8 crossing at old bridge	7/17/2008	86	dry	
71	Downstream of Route 8 crossing at old bridge	7/30/2008	160	dry	
71	Downstream of Route 8 crossing at old bridge	8/5/2008	550	dry	
71	Downstream of Route 8 crossing at old bridge	8/13/2008	63	dry	
71	Downstream of Route 8 crossing at old bridge	8/20/2008	220	dry	
71	Downstream of Route 8 crossing at old bridge	6/17/2009	81†	dry	171
71	Downstream of Route 8 crossing at old bridge	6/24/2009	74	wet	
71	Downstream of Route 8 crossing at old bridge	7/1/2009	180	dry	
71	Downstream of Route 8 crossing at old bridge	7/22/2009	5800	wet	
71	Downstream of Route 8 crossing at old bridge	8/5/2009	52	dry	
71	Downstream of Route 8 crossing at old bridge	8/12/2009	112†	dry	
71	Downstream of Route 8 crossing at old bridge	8/19/2009	250	dry	
71	Downstream of Route 8 crossing at old bridge	9/3/2009	98	dry	
71	Downstream of Route 8 crossing at old bridge	9/9/2009	140	dry	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 71 on Far Mill River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
71	Downstream of Route 8 crossing at old bridge	2006-2009	15	25	223	550	129
Shaded cells indicate an exceedance of water quality criteria **Weather condition determined from rain gage at Tweed KMMK station in New Haven, CT**							

REFERENCES

Costa, Joe (2011). Calculating Geometric Means. Buzzards Bay National Estuary Program. **Online**: http://www.buzzardsbay.org/geomean.htm

CTDEEP (2010). State of Connecticut Integrated Water Quality Report. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_management/305b/ctiwqr10final.pdf

CTDEEP (2011). State of Connecticut Water Quality Standards. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

CWP (2003). Impacts of Impervious Cover on Aquatic Systems. Center for Watershed Protection. **Online**: http://clear.uconn.edu/projects/tmdl/library/papers/Schueler_2003.pdf

Federal Register 67 (March 15, 2002) 11663-11670. Urban Area Criteria for Census 2000.

Mallin, M.A., K.E. Williams, E.C. Escham, R.P. Lowe (2000). Effect of Human Development on Bacteriological Water Quality in Coastal Wetlands. Ecological Applications 10: 1047-1056.

USEPA (2001). Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water. **Online**: http://www.epa.gov/safewater/sourcewater/pubs/fs_swpp_petwaste.pdf.

USEPA (2011a). Managing Nonpoint Source Pollution from Agriculture. **Online:** http://water.epa.gov/polwaste/nps/outreach/point6.cfm

USEPA (2011b). Riparian Zone and Stream Restoration. **Online:** http://epa.gov/ada/eco/riparian.html

USEPA (2011c). Land Use Impacts on Water. **Online**: http://epa.gov/greenkit/toolwq.htm